Fisheries and Oceans Canada | Pêches et Océans Canada
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Maritimes Region

Canadian Science Advisory Secretariat
Science Response 2018/037

STOCK STATUS UPDATE OF GEORGES BANK 'A' SCALLOPS (*PLACOPECTEN MAGELLANICUS*) IN SCALLOP FISHING AREA 27

Context

Advice on the status of the Georges Bank Scallop stock is requested annually by Fisheries and Oceans Canada (DFO) Resource Management to help determine a Total Allowable Catch (TAC, meat weight) in support of the fishery. The purpose of this report is to update the status of Georges Bank Scallop with data from the 2017 Scallop survey and fishery to provide science advice for the management of the 2018 fishery. The last peer-reviewed Regional Advisory Process for this stock occurred in 2013 (DFO 2013, Hubley et al. 2013) and updates were conducted for years 2014-2017 (DFO 2014, 2015, 2016, 2017).

This update for the Scallop fishery on Georges Bank pertains to zone 'a'. Georges Bank zone 'b' is a marginal growth area for scallops and has separate management measures. The assessment and advice presented in this document use the assessment framework established in 2009 (Jonsen et al. 2009) and are for Georges Bank zone 'a' only; some elements of the fishery in zone 'b' are also presented for continuity.

This Science Response reports results from the Science Response Process of April 18, 2018, on the Stock Status Update of Offshore Scallop: Browns Bank North and Georges Bank 'a'.

Analysis and Response

The location of Georges Bank 'a' and the other Offshore Scallop Fishing Areas (SFAs) is provided in Figure 1. The 2017 TAC was 3,500 tonnes (t) for zone 'a' and 200 t for zone 'b'. With quota carry forward, the adjusted 2017 TAC for zone 'a' was 3,530 t. Total reported landings in 2017 were 3,514 t for zone 'a' and 200 t for zone 'b' (Figure 2). Based upon preliminary analysis of the 2017 fishery data and the annual stock survey data, an interim TAC of 3,000 t was set in December 2017 for the 2018 Georges Bank zone 'a' fishery and 400 t for zone 'b'.

Science advice is provided for this stock using a Bayesian state-space modified delay difference assessment model that integrates both fishery and survey data and is described in Hubley et al. (2013). The model fit to the survey estimates of fully-recruited (≥ 95 mm shell height) biomass, recruit (85-94.9 mm) biomass, and fishery Catch Per Unit Effort (CPUE, kg/(hour-metre)) are shown in Figure 3. Estimates of fully-recruited biomass in 2017 and projections of fully-recruited biomass for 2018 under various catch scenarios are presented and compared to established reference points for this stock (Figure 4 and Table 1).

The modelled median fully-recruited biomass is estimated to be 21,272 t in 2017 (Figure 4). This is an increase from the 2016 estimate (20,591 t), and above the long-term median of 15,904 t (the long-term median calculations (1986-2016) exclude the current year (2017) estimates). The median recruit biomass is estimated to be 3,762 t in 2017, a 45% decline from the 2016

estimate (6,988 t) and the lowest estimate since 2007, but still above the long-term median biomass of 3,244 t.

Indicator of Stock Status

Georges Bank 'a' reference points are based on 30% and 80% of the mean biomass from 1986 to 2009 (Smith and Hubley 2012). The Lower Reference Point (LRP) is 7,137 t and the Upper Stock Reference (USR) is 13,284 t. The probability that the 2017 biomass is currently above the USR and in the Healthy Zone is approximately 0.99. The model forecasted median fully-recruited biomass for 2018 is 25,128 t. This forecast assumes:

- a catch of 3,000 t (the interim TAC),
- the condition of scallop in 2018 will be unchanged from 2017 (17.1 g/dm^3), and
- that natural mortality in 2018 will be unchanged from 2017 (0.09).

This represents an estimated 18.1% increase in fully-recruited biomass from 2017 to 2018.

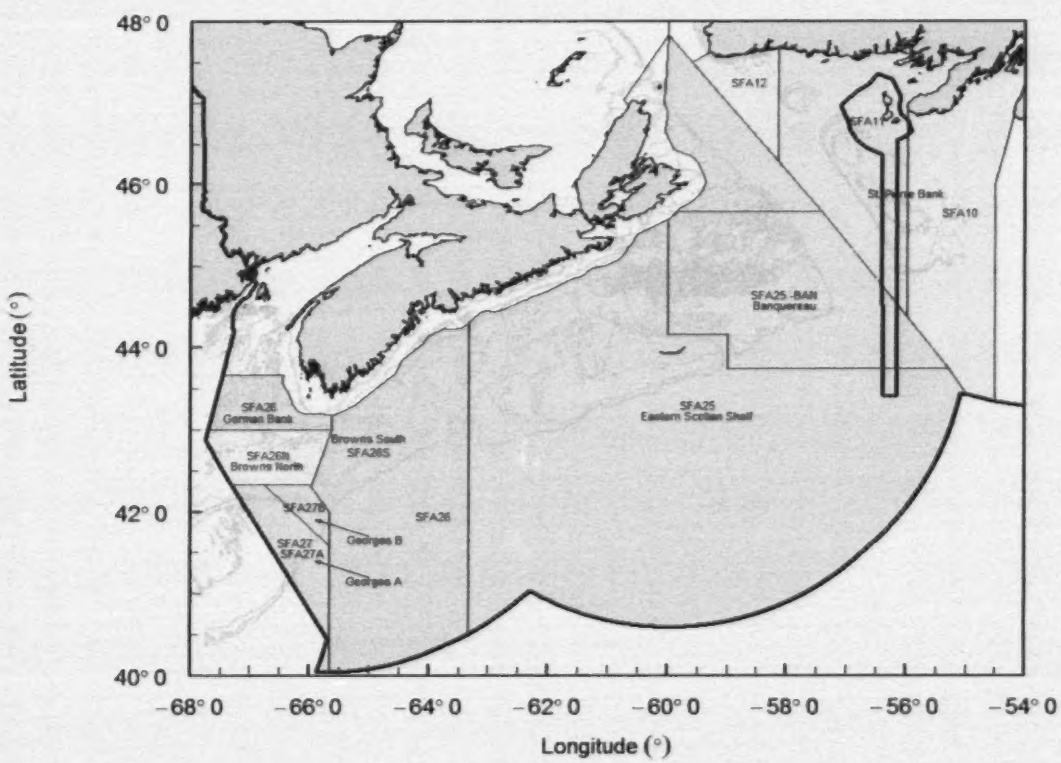

Figure 1: Map showing the offshore Scallop Fishing Areas (SFAs) 25-27 used for management purposes in the Maritimes Region. Note the division of Georges Bank 'a' and 'b' as subareas of SFA 27.

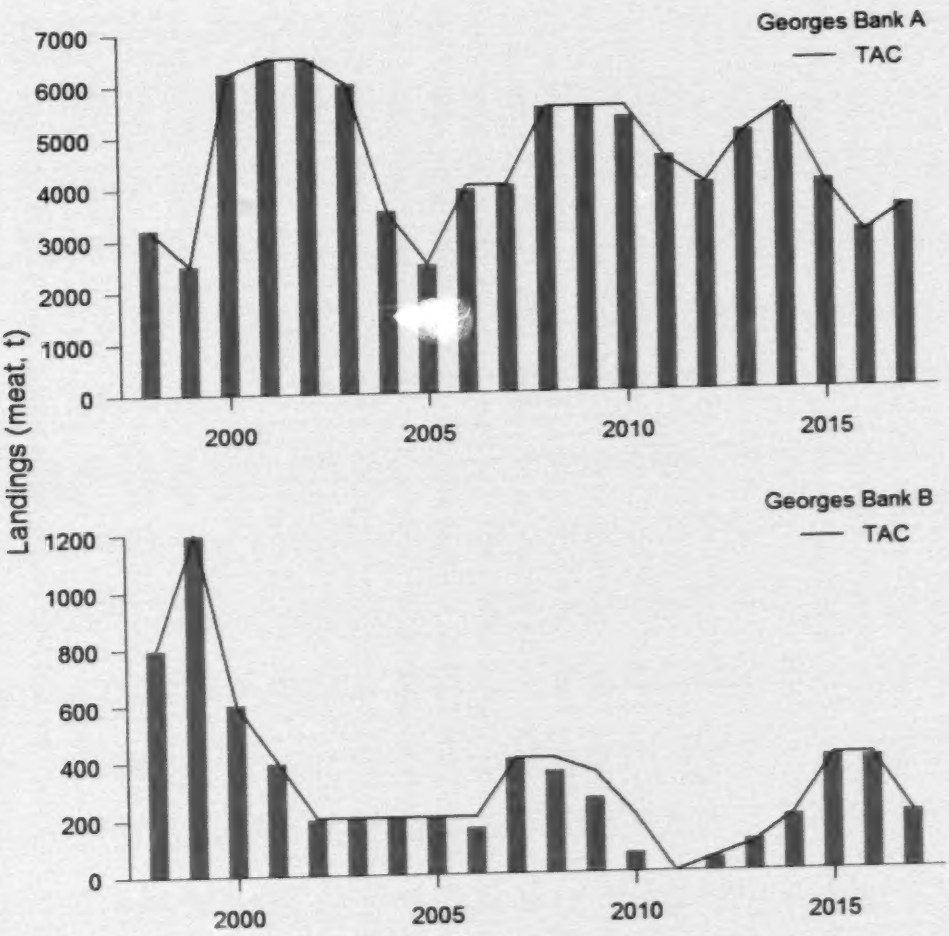

Figure 2. Landings of Scallop meats (tonnes) from Georges Bank 'a' (top panel), and 'b' (lower panel) between 1998 and 2017. The blue line represents Total Allowable Catch (TAC), in tonnes. Prior to 1998, landings from Georges Bank 'a' and 'b' were combined.

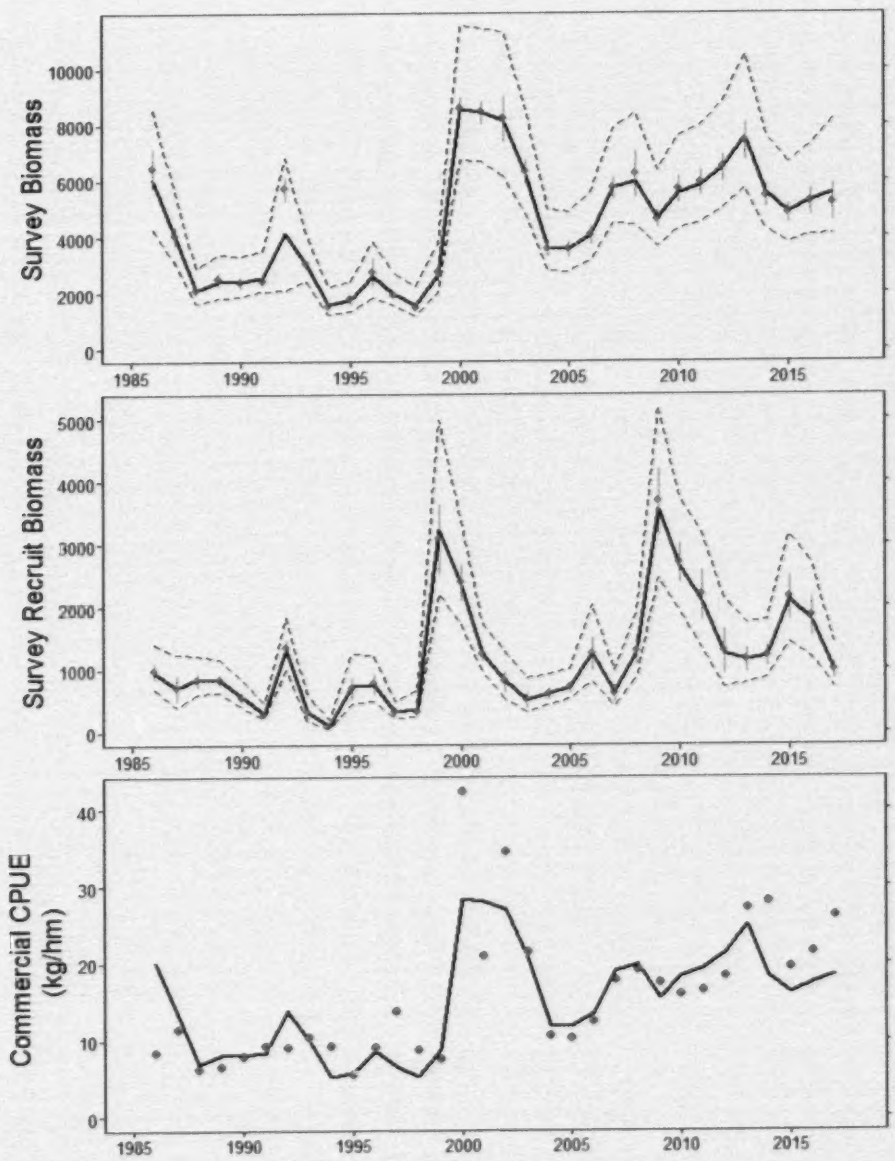

Figure 3. Summary of model results and inputs for fully-recruited (≥95 mm) survey biomass (top panel, in tonnes), recruit (85-94.9 mm) survey biomass (middle panel, in tonnes) and commercial Catch Per Unit Effort (CPUE) (bottom panel, in kg/hour-metre) $\frac{kg}{hour \times meter}$ for Georges Bank 'a'. Thick black line is the model estimate and the circles represent observed values from the survey and the fishery. For the survey data, the vertical lines represent the standard error associated with the observed values and the dashed lines represent the modelled 95% credible intervals.

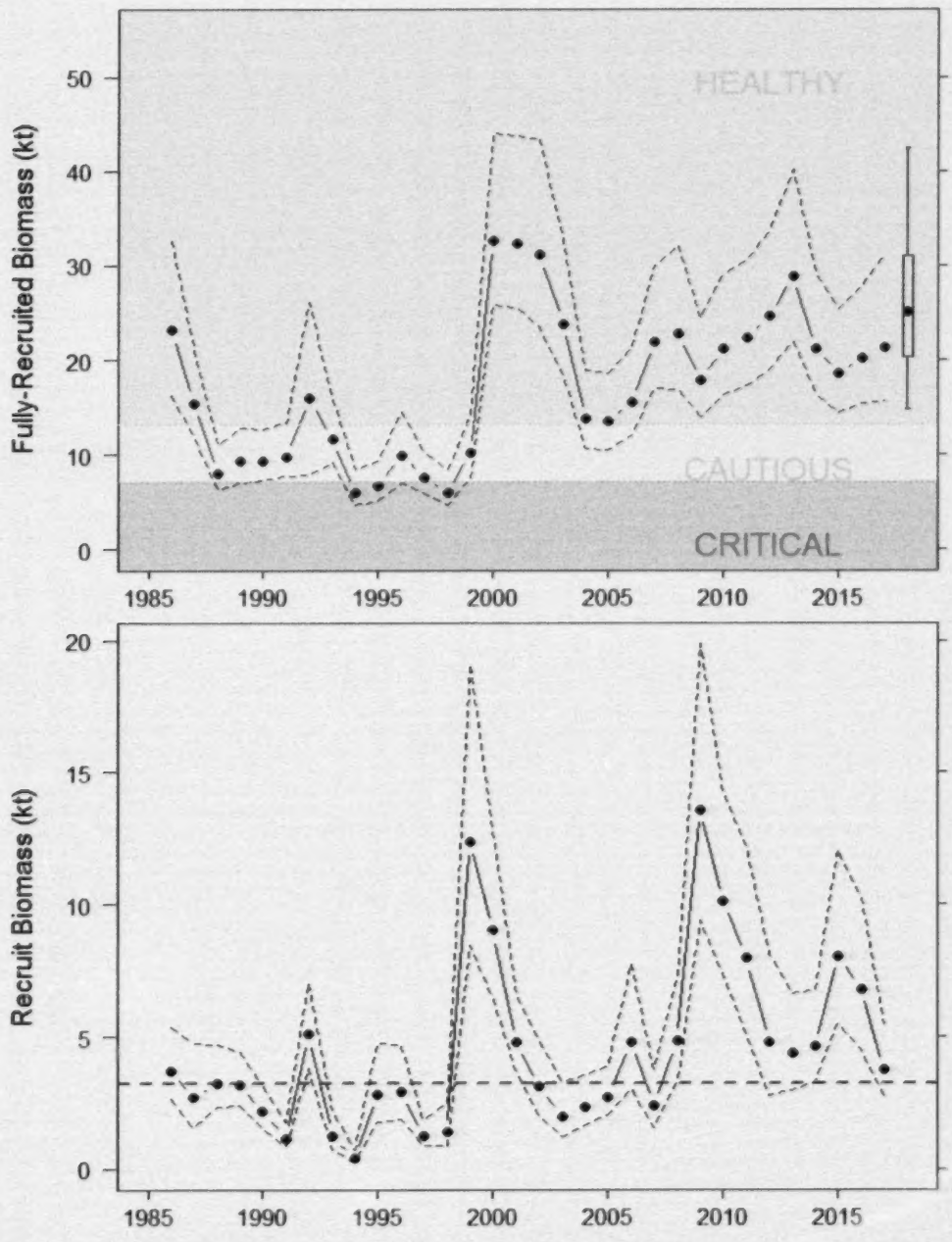

Figure 4. Biomass estimates (kilotonnes) for fully-recruited (≥ 95 mm) (top panel) and recruit (85-94.9 mm) (lower panel) scallops from the stock assessment model fit to the Georges Bank 'a' survey and commercial data. Dashed lines are the upper and lower 95% credible limits. Coloured zones (from top to bottom) represent the Healthy (green), Cautious (yellow) and Critical (red) zones (reference points described in text). The blue horizontal dashed line in the lower panel represents the long-term median recruit biomass. The forecasted fully-recruited biomass for 2018, assuming a catch of 3,000 t, is displayed as a box plot with median (•), 50% credible limits (box) and 80% credible limits (whiskers).

Table 1. Catch scenarios for Georges Bank 'a' in 2018 in terms of exploitation and expected changes in fully-recruited biomass. Potential catches in 2018 are evaluated in terms of the probability of a decline in biomass and exceeding reference points (Upper Stock Reference (USR) and Lower Reference Point (LRP)). These probabilities account for uncertainty in the biomass forecasts.

Catch (t)	Exploitation Rate	Probability of Biomass Decline	Expected Change in Biomass (%)	Probability Biomass will Exceed USR	Probability Biomass will Exceed LRP
1000	0.05	0.25	28	0.96	>0.99
1500	0.06	0.27	25	0.96	>0.99
2000	0.08	0.29	22	0.95	>0.99
2500	0.10	0.31	19	0.94	>0.99
3000	0.12	0.33	17	0.94	>0.99
3500	0.13	0.35	14	0.93	>0.99
4000	0.15	0.38	12	0.92	>0.99
4500	0.17	0.40	9	0.91	>0.99
5000	0.19	0.43	6	0.90	>0.99
5500	0.21	0.46	4	0.89	0.99
6000	0.23	0.49	1	0.88	0.99
6500	0.24	0.52	-2	0.86	0.99

Conclusions

The 2018 interim TAC of 3,000 t results in an exploitation rate of 0.12. Catch scenarios ranging from 1,000 t to 6,500 t are presented in Table 1. All catch scenarios below 6,500 t are projected to result in increases in fully-recruited biomass, with a probability of biomass decline ranging from 0.25 to 0.52. The probability that biomass will remain in the Healthy Zone is ≥ 0.86 for all catch scenarios presented (Table 1).

Contributors

Name	Affiliation
Lottie Bennett (Chiar)	DFO Science, Maritimes Region
David Keith (Co-Lead)	DFO Science, Maritimes Region
Freya Keyser (Co-Lead)	DFO Science, Maritimes Region
Tricia Pearo Drew	DFO Science, Maritimes Region
Brendan Wringe	DFO Science, Maritimes Region
Manon Cassista-Da Ros	DFO Science, Maritimes Region
Alan Reeves	DFO Resource Management, Maritimes Region

Approved by

Alain Vézina
Regional Director of Science
DFO Maritimes Region
Dartmouth, Nova Scotia
Ph. 902-426-3490

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Center for Science Advice (CSA)
Maritimes Region
Fisheries and Oceans Canada
Bedford Institute of Oceanography
1 Challenger Drive, PO Box 1006
Dartmouth, Nova Scotia B2Y 4A2

Telephone: 902-426-7070
E-Mail: XMARMRAP@dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas-sccs/

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